

TECHNICAL NOTES

Effect of Reconstitution on Vitamins A and C Content
of Whey-Soy Drink Mix

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ABSTRACT

The nutritive quality of a whey-soy drink mix was determined by measuring the retention of added vitamins A and C after the product was reconstituted in boiling water. In one study the mix was mixed in boiling water for up to 5 min and analyzed for vitamin content after each 1 min heating interval. The reconstituted product lost approximately 50% of the original vitamin content after being boiled for 1 min. Little further decrease in vitamin content was observed after several additional minutes of boiling until the 5-min interval when both vitamins dropped to about 35% of original amounts.

In another study the mix was reconstituted by mixing the powder in boiling water for 20 s, then allowing the mix to stand at room temperature with no additional heating. This mixture decreased slightly in vitamin content when analyzed at 5 min intervals for up to 25 min.

For maximum vitamin retention whey-soy drink mix should be reconstituted by blending it in boiling water for about .5 min, then allowing the mixture to stand at room temperature before serving.

INTRODUCTION

Whey-soy drink mix (WSDM) was formulated to serve as a nonfat dry milk replacer in international child feeding programs when nonfat dry milk was in short supply and priced out of reach for overseas distribution (3).

Under commodity specifications (5), WSDM must contain, among other ingredients, vita-

mins A and C. From observations while assisting in the introduction of WSDM in a Public Law (PL) 480, Title II feeding program, Wilding (6) recommended determining the nutritional quality of whey-soy drink mix reconstituted in boiling water. This study was undertaken to measure the retention of vitamins A and C in WSDM as affected by reconstitution practices. Based on the descriptive material in the above-named report, two heating studies were conducted.

In one study, WSDM was reconstituted in boiling water and then allowed to boil for up to 5 min. In another study WSDM was mixed with boiling water, then allowed to stand at room temperature with no further heating. Retention of vitamin A and ascorbic acid was measured.

MATERIALS AND METHODS

Whey-soy drink mix prepared commercially under commodity specifications (5) was utilized. This product was formulated to contain a minimum of 8750 USP units vitamin A and 212.4 mg ascorbic acid per pound of dry product (3.5% moisture). Initially, the WSDM was reconstituted to about 16% total solids by mixing, for example, 15 g of dry product with 75 ml boiling water and blending for exactly 20 s in a blender set at reduced speed. This was considered as the zero time sample. Subsequent samples of WSDM were weighed and reconstituted in like manner. The mixture then was transferred to a heated beaker, and the boiling was continued with constant stirring on a stirring hot plate for 1 to 5 min. The hot plate temperature setting was adjusted to maintain boiling without boil over. After the specified time the mixture was chilled as quickly as possible by placing the beaker in cracked ice and blanketing the mixture with nitrogen to prevent oxidative deterioration. When thoroughly chilled, the reconstituted WSDM was divided in half and frozen until analyzed for

vitamin A and ascorbic acid content.

In the second study 60 g WSDM were mixed with 300 ml boiling deionized water in a preheated blender cup. After the usual 20 s blending, the reconstituted sample was allowed to stand at room temperature with no further heating for 0, 5, 15, and 25 min. After each time the mixture was sampled for vitamin assay and the temperature was noted. The sample was chilled rapidly in crushed ice as before, then frozen and stored until assayed. All reagents and solvents were reagent grade. Vitamin A was determined by an AOAC procedure (1).

The spectrophotometric method of Loeffler and Ponting (4) was used for determination of ascorbic acid with the following modifications, the reconstituted samples were extracted with a solution of metaphosphoric acid, acetic acid, and methanol (2). The presence of methanol eliminated turbidity due to lipid components in the samples. Also, to compensate for the dilution effect of the reconstituted samples, the acid content of the extracting solution was increased by 20% as follows: 50 g metaphosphoric acid were mixed with 200 ml glacial acetic acid and 800 ml methanol in deionized water. The solution, made to a final volume of 2 liters, had a shelf life of 7 to 10 days.

RESULTS AND DISCUSSION

Figure 1 shows the effect of boiling time on the survival of both vitamin A and ascorbic acid in whey-soy drink mix (WSDM). Retention of the original ascorbic acid in WSDM was approximately 61% after the powder was mixed in boiling water for 20 s, 48% after additional boiling for 1 min, and 30% after boiling for 5 min. Retention of the original vitamin A in WSDM was approximately 92% after the powder was mixed in boiling water for 20 s, 75% after additional boiling for 1 min, 51% after the 2- to 4-min boiling intervals, and 40% after boiling for 5 min. These data indicate considerable decline in the nutritive value of WSDM reconstituted in the latter manner as manifested by retained vitamin content.

The retention of vitamin A and ascorbic acid in WSDM reconstituted in boiling water and then allowed to stand at room temperature with no further heating also was determined. Ascorbic acid immediately decreased (about 22%) (Fig. 2) when WSDM powder was mixed

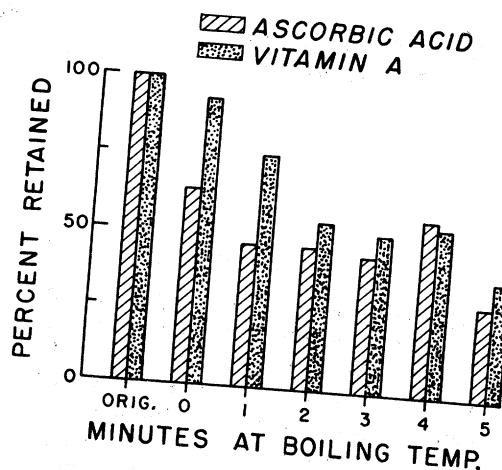


FIG. 1. Vitamin retention as a function of the boiling interval during reconstitution of whey-soy drink mix.

with boiling water for 20 s but showed little additional loss when the reconstituted WSDM was allowed to stand up to 25 min at room temperature. Vitamin A remained relatively unchanged until after 25 min standing at which time it showed an 18% loss (Fig. 2).

Also in Fig. 2 is the temperature profile of this sample as a function of time of standing. From zero time (100 C) to 25 min standing with no further heating, the temperature of the

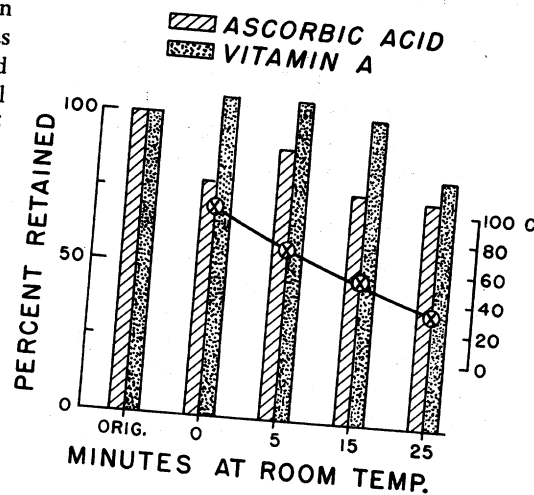


FIG. 2. Effect of standing at room temperature (after reconstitution) on the vitamins retained in whey-soy drink mix.

reconstituted WSDM dropped to 36 C.

CONCLUSION

A considerable decrease in the nutritive value of WSDM as a function of vitamin A and C retention results from excessive heating when the product is reconstituted in boiling water. By contrast, most of the added vitamins remain available if heating is terminated within 20 s after reconstitution. In fact, instructions recommend boiling the water, removing from heat, then adding the WSDM. This recommended procedure appears to be most suited for maximum retention of vitamin content and maintenance of the highly nutritious quality of this product.

ACKNOWLEDGMENTS

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